**Mechanics: Work, Energy and Power Worksheet Name:**

**Work Questions:**

1. A tugboat pulls a ship with a constant net horizontal force of 5.00 x 103 N and causes the ship to move through a harbor. How much work is done on the ship if it moves a distance of 3.00 km?
2. A shopper in a supermarket pushes a cart with a force of 35 N directed at an angle of 25° downward from the horizontal. Find the work done by the shopper on the cart as the shopper moves along a 50.0 m length of aisle.
3. If 2.0 J of work is done in raising a 180 g apple, how far is it lifted?
4. For each of the following cases, indicate whether the work done on the second object in each example will have a positive or negative value.
   1. The road exerts a friction force on a speeding car skidding to a stop.
   2. A rope exerts a force on a bucket as the bucket is raised up a well.
   3. Air exerts a force on a parachute as the parachutist falls to Earth.

**Kinetic Energy Questions:**

1. What is the speed of a 0.145 kg baseball if its kinetic energy is 109 J?
2. Two 3.0 g bullets are fired with speeds of 40.0 m/s and 80.0 m/s respectively. What are their kinetic energies? Which bullet has more kinetic energy? What is the ratio of their kinetic energies?
3. A car has a kinetic energy of 4.32 x 105 J when traveling at a speed of 23 m/s. What is its mass?

**Work-Kinetic Energy Theorem Questions:**

1. A student wearing frictionless roller skates on a horizontal surface is pushed by a friend with a constant force of 45 N. How far must the student be pushed, starting from rest, so that her final kinetic energy is 352 J?
2. A 2.1 x 103 kg car starts from rest at the top of a driveway that is sloped at an angle of 20.0° with the horizontal. An average friction force of 4.0 x 103 N impedes the car’s motion so that the car’s speed at the bottom of the driveway is 3.8 m/s. What was the length of the driveway?
3. A 75 kg bobsled is pushed along a horizontal surface by two athletes. After the bobsled is pushed a distance of 4.5 m starting from rest, its speed is 6.0 m/s. Find the magnitude of the net force on the bobsled.
4. A 755 N diver drops from a board 10.0 m above the water’s surface. Find the diver’s speed 5.00 m above the water’s surface. Then find the diver’s speed just before striking the water.
5. If the diver in problem 11 leaves the board with an initial upward speed of 2.00 m/s, find the diver’s speed when striking the water.
6. A pendulum bob is released from some initial height such that the speed of the bob at the bottom of the swing is 1.9 m/s. What is the initial height of the bob?

**Power Questions:**

1. A 1.0 x 103 kg elevator carries a maximum load of 800.0 kg. A constant frictional force of 4.0 x 103 N retards the elevator’s upward motion. What minimum power, in kilowatts, must the motor deliver to lift the fully loaded elevator at a constant speed of 3.00 m/s?
2. A rain cloud contains 2.66 x 107 kg of water vapor. How long would it take for a 2.00 kW pump to raise the same amount of water to the cloud’s altitude of 2.00 km?
3. A 1.50 x 103 kg car accelerates uniformly from rest to 10.0 m/s in 3.00 s.
   1. What is the work done on the car in this time interval?
   2. What is the power delivered by the engine in this time interval?